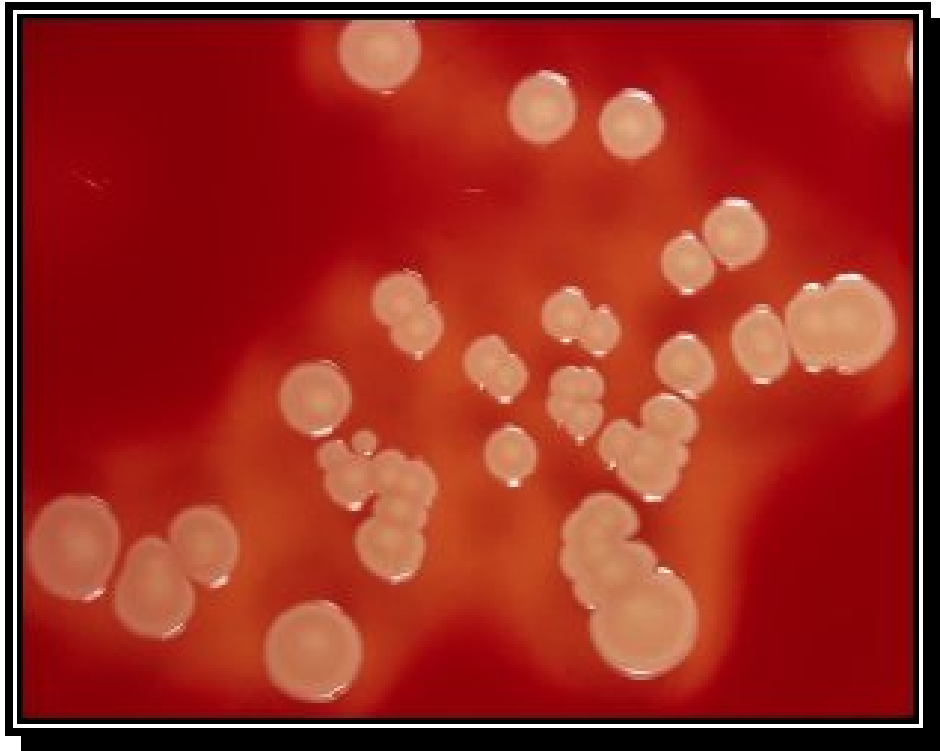


COMMUNITY ASSOCIATED METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* (CA MRSA)

Guidelines for Clinical Management and Control of Transmission

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Background

Staphylococcus aureus is a bacterium commonly found on the skin, axillae, perineum, and in the nares of healthy individuals. At least 30% of the population may permanently or intermittently carry *S. aureus*. Since the introduction of antibiotics decades ago, “staph” has quickly become resistant to many significant antibiotics such as the beta-lactams and macrolides.

Healthcare associated MRSA (HA MRSA) first appeared in the 1960s and has typically been linked to persons with health care associated risk factors such as hospitalization or nursing home care, chronic dialysis, antibiotic treatment, or exposure to invasive devices or procedures. HA MRSA is a highly resistant and important nosocomial pathogen in both acute care and long term care settings and causes infections associated with increased morbidity, mortality, and cost when compared to infections due to susceptible strains of *S. aureus*.

Beginning in the 1990s community associated MRSA (CA MRSA) infections emerged in persons having none of the risk factors associated with MRSA in the past. Genetic and epidemiologic evidence shows that CA MRSA is caused by strains of *S. aureus* different from those associated with HA MRSA.

CA MRSA is currently defined as an infection with MRSA in a person who does not have any prior history of a health care exposure such as hospitalization, surgery, permanent intravenous lines or other indwelling devices, or hemodialysis.

Characteristics of CA MRSA

CA MRSA strains are genetically different from HA MRSA strains. The predominant strains of CA MRSA are the genetic fingerprint types US 300 and US 400 strains, which contain the staphylococcal chromosomal cassette (SCC) *mec* IV, a smaller version of the genetic package that confers resistance, in comparison to the SCC*mec* I, II, III, and V, found in the US 100 and 200 strains that correlate with HA MRSA. **The smaller size of the SCC confers less resistance on the organism than the larger SCC, and explains why CA MRSA is susceptible to more classes of antibiotics than HA MRSA.** The former is always resistant to the beta-lactams and often to erythromycin, but remains susceptible to several other antimicrobial agents. HA MRSA is resistant to all classes of antibiotics except vancomycin, linezolid, quinoprisitin-dalfopristin, daptomycin, and tigecycline.

Almost 100 percent of CA MRSA strains also possess the Panton Valentine Leukocidin (PVL) gene that allows the production of a necrotizing cytotoxin, which may be responsible for the invasiveness and virulence of the organism. In contrast, only about 5 percent of methicillin susceptible strains of *S. aureus* and HA MRSA carry the PVL gene.

The most frequent infections caused by CA MRSA are skin and soft tissue infections that typically present as boils, abscesses, or cellulitis. Early lesions often appear as spider bites. Although less commonly, CA MRSA can cause the full spectrum of infections, such as bacteremias, surgical site infections, and pneumonias.

Table 1 below summarizes the differences between HA MRSA and CA MRSA.

Table 1. Comparison of HA MRSA and CA MRSA¹³

	HA-MRSA	CA-MRSA
Health care contact	Yes	No
Mean age at infection	Older	Younger
Skin and soft tissue infections	35%	75%
Antibiotic resistance	Many agents	Some agents
Resistance gene	SCCmec Types I, II,III	SCCmec Type IV, V
Strain type	USA 100 and 200	USA 300 and 400
PVL toxin gene	Rare (5%)	Frequent (almost 100%)

Epidemiology

CA MRSA is an emerging pathogen among persons with none of the risk factors traditionally associated with HA MRSA (history of hospitalization, residence in nursing home, dialysis treatment, invasive devices and procedures, and antibiotic use). Limited data from the Centers for Disease Control and Prevention (CDC) suggest wide geographic variation of infection rates, ranging from 26 cases per 100,000 population in Atlanta to 18 cases per 100,000 population in Baltimore. Children under 2 years of age, Native Americans, Pacific Islanders, and Alaskan Natives appear to have greater susceptibility to CA MRSA. The incidence and prevalence of CA MRSA in Wisconsin is unknown at this time.

Although CA MRSA is probably found in less than one percent of the population, it has caused outbreaks among members of sports teams, including football, wrestling, and fencing teams, and among prisoners, military recruits, men who have sex with men, and injection drug users. Transmission occurs predominately by person to person spread but may also occur by indirect contact with contaminated surfaces or items. Little is known about risk factors for transmission in community settings, except that common factors observed from outbreak investigations were crowding, frequent skin to skin contact, compromised skin, contaminated surfaces and shared items, and lack of cleanliness. CA MRSA transmission in hospital settings has also been demonstrated in outbreaks among postpartum women and in patients undergoing orthopedic surgery, prompting the use of contact precautions in acute care settings.

Recent nasal acquisition of CA MRSA has been associated with a 10-fold increase in risk of developing skin and soft tissue infections. However, nasal carriage may not be a reliable epidemiologic marker for CA MRSA. Of interest, persons previously colonized with *S. aureus* have a lower relative risk of developing more invasive disease. These data suggest that some immunity is provided by colonization.

Treatment

CA MRSA should be considered in the differential diagnosis of patients with skin and soft tissue infections that are compatible with *S. aureus* infections (abscesses, pustular lesions, boils, and lesions appearing as “spider bites”). It should also be considered, although it occurs less frequently, in severe diseases that are compatible with *S. aureus* infection (sepsis syndrome, osteomyelitis, necrotizing pneumonia, septic arthritis, and necrotizing fasciitis).

Although risk factors for CA MRSA are not well defined, patients with characteristics listed in Table 2 should be considered at higher risk of having CA MRSA.

Table 2. Risk factors associated with CA MRSA infections¹⁴

The following risk factors should increase suspicion for CA MRSA in patients presenting with compatible signs and symptoms.

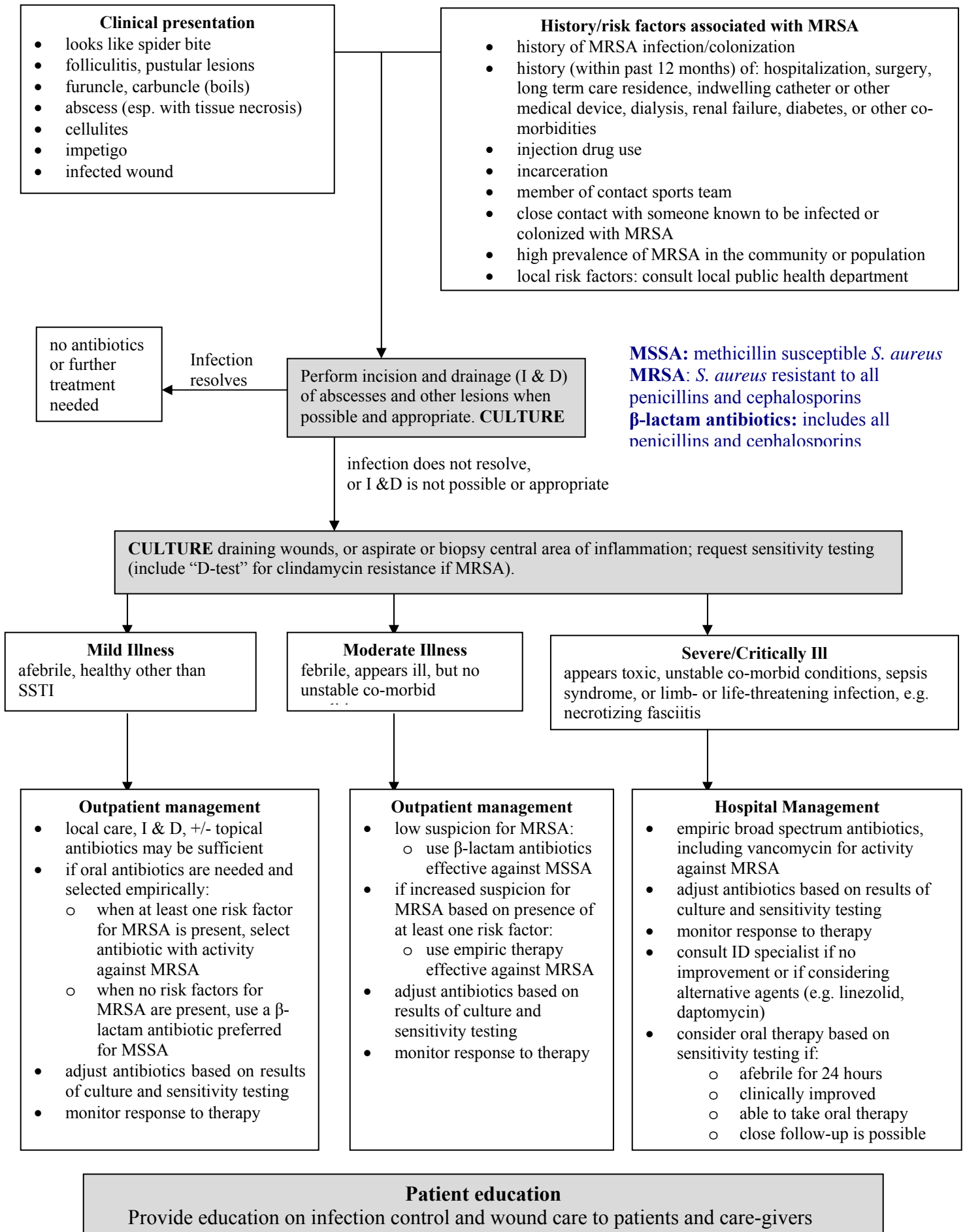
- History of MRSA infection or colonization in patient or close contact
- High prevalence of CA MRSA in local community or patient population
- Recurrent skin disease
- Crowded living conditions (e.g. homeless shelters, military barracks)
- History of incarceration
- Participation in contact sports
- Skin or soft tissue infection with poor response to B-lactam antibiotics
- Recent and/or frequent antibiotic use
- Injection drug use
- Member of Native American, Pacific Island, Alaskan Native populations
- Child under 2 years of age
- Male with history of having sex with men
- Shaving of body hair

If infection with *S. aureus*/MRSA is suspected, the following evaluation and management steps should be applied (see Figure 1: “Guidelines for Management of Suspected *Staphylococcus aureus* Skin and Soft Tissue Infections”).

1. Perform incision and drainage of abscesses, **which is the primary and often the only therapy necessary for such infections.**
2. **Obtain material for culture when possible.** Culture results will help guide clinical management and facilitates provision of important information on prevalence, risk factors, and susceptibility patterns.
3. Instruct outpatients to return if they develop signs and symptoms of systemic illness, have worsening local symptoms, or if no improvement is seen in 48 to 72 hours.
4. If outpatient antibiotic therapy is deemed necessary, select empiric antibiotic therapy based on local prevalence of MRSA, severity of illness, and patient co-morbidities.
 - a. Topical 2% mupirocin may be used for less severe cases when the use of systemic antibiotics is not advisable. Bacitracin has been shown to be almost as effective as mupirocin, and may be used as an alternative when cost of treatment is a consideration.
 - b. TMP/SMX is the antibiotic to which MRSA is most frequently sensitive in vitro (> 90% of isolates test sensitive). However, the penetration of TMP/SMX into abscesses may be compromised, possibly limiting its efficacy in undrained abscesses. Laboratory confirmation of susceptibility may be delayed for two to three days because many microbiology laboratories do not have routine TMP/SMX testing capacity in automated systems.
 - c. Clindamycin may be used when the isolate is susceptible to BOTH clindamycin and erythromycin. All laboratories should perform a “D” test when the isolate is susceptible to clindamycin but resistant to erythromycin, to detect erythromycin-induced resistance to clindamycin (see laboratory testing section). This may also delay susceptibility reporting for several days, but treatment failures with clindamycin may occur if inducible resistance is not detected. Approximately 70-75% of isolates are susceptible at this time (October 2005) but inducible resistance appears to be increasing in frequency.
 - d. Tetracycline (or doxycycline) may be used if the organism is susceptible, even though it has relatively less intrinsic antistaphylococcal activity.
 - e. Under most circumstances macrolides and fluoroquinolones are not optimal drugs against MRSA, even if the microbiology laboratory reports the isolate as susceptible, because of the risk of rapid development of resistance.
5. Provide patient education on wound care, hand washing, and hygiene at home (see Appendix 1: Information for Patients with Methicillin Resistant *Staphylococcus aureus* Infections).

Figure 1.

Guidelines for management of suspected *Staphylococcus aureus* skin and soft tissue infections (SSTI)⁵



Decolonization

Nasal carriage of MRSA or methicillin susceptible *S. aureus* is a risk factor for development of subsequent infections with these organisms.

Persons colonized with HA MRSA are considered to be reservoirs for patient to patient transmission via health care workers' hands in healthcare settings. Measures to decolonize patients and staff with topical intranasal mupirocin have been used to control outbreaks and ongoing transmission in health care settings. Decolonization can be temporarily achieved but a significant portion of patients and health care workers become re-colonized within a relatively short time. Short-term mupirocin use may interrupt nosocomial outbreaks, but infection control measures may be equally or more important. Hemodialysis patients with recurrent bacteremias may benefit from decolonization treatment. Decolonization may also be beneficial in preventing surgical site infections in patients undergoing certain orthopedic or cardiac surgeries. Health care workers should not be routinely screened and treated for nasal carriage unless shown to have an epidemiologic link in an outbreak. In summary, the decision to treat colonized patients should be made on a case-by-case basis with consideration of clinical and/or epidemiologic circumstances.

Regarding CA MRSA, routine use of mupirocin to achieve decolonization is not routinely recommended. It does not usually prevent subsequent infections with *S. aureus* or MRSA in all patients, and mupirocin resistance has emerged. Decolonization may be considered in patients with recurrent CA-MRSA infections or in households with several members who have CA MRSA skin and soft tissue infections. However, little data exist to determine the effectiveness of decolonization in the non-healthcare setting. Other strategies to prevent transmission in households and community settings should be emphasized first (see prevention and control section).

Family contacts of patients with CA MRSA should not be routinely screened for MRSA unless there are extenuating circumstances, such as multiple household contacts with skin and soft tissue infections, or members with compromised immunity.

Table 3. Guidelines for eradicating MRSA colonization

1. Do not routinely attempt to decolonize all patients with MRSA colonization. Only patients likely to benefit clinically should be treated.
2. The treatment of choice is topical intranasal mupirocin (2%) applied to the anterior nares 2 to 3 times a day for 5 days (not for extended time intervals).
3. Patients colonized at multiple sites or those with chronic wounds, ulcers, or indwelling devices are less likely to respond to decolonization attempts. Treatment should be limited to a 10 day course to avoid development of mupirocin-resistant strains of MRSA.
4. Daily bathing or showering using an antibacterial agent such as chlorhexidine gluconate is recommended during mupirocin treatment to improve chances of eradication. Alternative treatment with tea tree oil body lotion and shampoo have been shown effective in achieving decolonization, and have the benefit of being less harsh on the skin.⁶
5. Routine follow-up cultures, in the absence of recurrent clinical signs of skin or other sites of infection, is not usually recommended but may be performed in selected circumstances.
6. Oral or IV antibiotics should not routinely be administered. In selected patients, a short course of oral antibiotics not to exceed 10 days may assist in the decolonization effort. Repeat courses of antibiotics should not be administered.
7. Only health care workers suspected to transmit MRSA should be screened and treated for carriage of MRSA.

Prevention and Control of Transmission of MRSA

Infection Control Measures in Health Care Settings

CA MRSA can be transmitted in the health care setting. Transmission occurs from patient to patient mainly by health care workers' hands that become contaminated from patient contact or contact with contaminated items.

In addition to standard precautions, contact precautions should be used for all patients with known MRSA infections, for patients with skin or soft tissue infections compatible with a diagnosis of a staphylococcal infection until susceptibilities are known, and for all patients with uncontained body secretions or wound drainage.

Wisconsin's Division of Public Health "Guidelines for Prevention and Control of Antibiotic Resistant Organisms in Health Care Settings" provides detailed infection control measures for healthcare settings.

They may be found on the DPH website at

<http://dhfs.wisconsin.gov/communicable/Communicable/HlthProvider.htm>.

Prevention of Transmission in Community Settings

Transmission of CA MRSA is associated with skin-to-skin contact and with contact of environmental surfaces that have become contaminated. Outbreaks of skin infections have occurred among members of athletic teams, inmates of correctional facilities, and patrons of health clubs. Common characteristics of settings in which CA MRSA has spread are close personal contact due to crowded conditions, lack of cleanliness, and activities which cause skin breakdown (e.g. football and other contact sports).

Since CA MRSA is an emerging pathogen, more studies are needed to determine the best methods for controlling and preventing the spread of MRSA in the community. Current strategies that appear to be successful include increased awareness, early detection and appropriate treatment, and maintaining a clean environment.

- Increased awareness: Health care providers should be aware that CA MRSA is a possibility in patients with skin and soft tissue infections and in those presenting with more severe illness compatible with *S. aureus* infection. They should have an increased level of suspicion in patients with one or more risk factors listed in Table 2.
- Early detection and appropriate treatment: Methods to screen for early signs and symptoms of skin and soft tissue infections should be implemented in correctional facilities, among contact sports participants, and in settings where persons share close living spaces (e.g. homeless shelters, camps, boarding schools, daycare settings). Close contacts of persons with confirmed CA MRSA infections should be monitored for signs and symptoms of MRSA infection. If treatment is necessary, health care providers should be informed that the patient is a close contact of a MRSA case patient. Outbreaks of MRSA in community settings should be reported to the local public health department.
- Maintaining a clean environment: Implementing steps to improve personal hygiene and environmental cleanliness appears to help control transmission of MRSA in crowded conditions and where use of shared items and equipment is common. See Appendix 2: "Guidelines for Personal Hygiene and Environmental Cleanliness in Community Settings."

Appendix 1: Information for Patients with Methicillin Resistant *Staphylococcus aureus* (MRSA) Infections

What is MRSA?

MRSA is a type of *Staphylococcus*, or “staph” bacterium that has developed resistance to the antibiotics usually used to treat persons with staph infections. Antibiotics that work against some staph infections but do not work against MRSA include dicloxacillin and cephalexin.

Staphylococcus aureus can be found on the skin or mucous membranes of approximately 25 to 30 percent of the US population. Of those persons who carry *S. aureus*, only about 1 percent carry CA MRSA. Most people do not have symptoms of infection but simply carry staph or MRSA on their skin or in their noses.

Who usually gets infections from MRSA?

MRSA infections occur most often in hospital patients, nursing home residents, or dialysis patients. They usually have weakened immune systems, chronic diseases, or have indwelling devices such as IV lines or tracheotomies. This type of MRSA infection is caused by healthcare associated MRSA (HA MRSA), which usually causes surgical wound infections, bloodstream infections, and pneumonia.

What is Community Associated MRSA (CA MRSA)?

CA MRSA infections involve strains of MRSA that can cause infections in healthy persons who have not been patients in health care facilities. CA MRSA usually causes skin infections such as pimples and boils but occasionally causes more serious infections. Some patients may think they have spider bites in the early phase of these infections.

Anyone can acquire CA MRSA infections, but many cases have been found in athletes, military recruits, prisoners, Native Americans, Pacific Islanders, Alaskan Natives, and children. Factors that seem to increase the chances of acquiring an infection with CA MRSA are close skin-to-skin contact, cuts, cracks, or abrasions in the skin, crowded living conditions, and poor hygiene.

How is an infection with CA MRSA treated?

Treatment of CA MRSA infections depends on the severity of the infection. Many skin infections can be cured with simple drainage of abscesses or pimples **without the need for antibiotics**. More serious infections may need oral, or rarely, intravenous antibiotic treatment. Your health care provider will be able to determine the best course of treatment for your condition.

What should I do if I have been diagnosed with a CA MRSA infection?

It is very important to follow the instructions from your health care provider. Your cooperation in treating the infection will help you to get healthy as quickly as possible. Follow these steps:

1. Follow the wound care instructions given to you by your health care provider.
2. If you received antibiotics or other medicines, be sure to take them according to the instructions given. Take your antibiotics until they are gone, even after symptoms have improved, unless your provider tells you otherwise.
3. Let your provider know if your symptoms become worse or do not get better within a few days. Be sure to return for any scheduled follow-up visits so your provider can determine whether your treatment is working.
4. Help prevent the spread of infection to others in your household by practicing these precautions until the wound or lesions are healed:
 - a. Wash your hands often with soap and warm water. It is especially important to wash hands before close contact with others, after touching infected areas, after handling soiled bandages and dressings, and after contact with infected body fluids. Alcohol hand sanitizer may be used if hands are not visibly soiled.
 - b. Instruct others to wash their hands after close contact with you and after assisting with wound care or following contact with dressings, wound drainage, or other infected body fluids.

- c. Persons caring for you should consider use of clean, disposable gloves when touching wound drainage, changing dressings, or handling infected body fluids. Wash hands immediately after removing gloves. Gloves may be discarded into the regular trash unless heavily soiled, in which case they should be placed in a plastic bag, sealed, and then placed into the regular trash.
- d. Cover the areas of skin or wound infections with a bandage or clean, dry dressing unless instructed otherwise by your provider. If drainage cannot be contained by dressings, use disposable or cloth pads to provide a barrier between infected areas and environmental surfaces.
- e. Dispose of heavily soiled used bandages, dressings, and disposable barriers by placing in a plastic bag before discarding into the regular trash. If not heavily soiled, they may be placed directly into the trash.
- f. Consider showering, especially with an antibacterial soap, before close physical contact with others.
- g. If wound drainage or other infected body fluids cannot be contained, limit physical contact (e.g. hugging, hand shaking, sharing beds) with others until drainage or body fluids can be contained.
- h. Do not share personal items such as razors, towels, or clothing, with others. Towels, clothing, and linens heavily soiled with wound drainage should be laundered in hot water and detergent, or in warm water with chlorine bleach. Drying in a hot dryer (180°F) will also help sanitize laundry before use by others.
- i. Clean and disinfect surfaces and objects in your immediate environment that may have become contaminated with wound drainage or infected body fluids. Wipe surfaces with a household disinfectant such as Lysol® or a bleach solution (1 cup bleach plus 9 cups water) and allow to air dry.

Appendix 2: Guidelines for Personal Hygiene and Environmental Cleanliness in Community Settings

CA MRSA is most frequently transmitted from person to person by direct physical contact with an infected person. Since MRSA is located on the hands and skin and is found in infected wounds and body fluids, they are important factors in how MRSA infections are spread. MRSA may also be spread indirectly by contaminated items and surfaces, although transmission occurs less often by this means.

One of the most important ways to protect against infections with CA MRSA is to keep skin intact. Using protective gloves and clothing when performing activities likely to cause punctures, scratches, cuts, abrasions, or other injuries to the skin will help prevent CA MRSA from causing skin and soft tissue infections. If injury to the skin does occur, the wound should be cleaned immediately with soap and warm water, dried, and then covered with a clean, dry bandage or dressing.

Other important strategies to prevent transmission of MRSA are hand washing, containing wound drainage and infected body fluids, and cleaning and disinfecting contaminated items and environmental surfaces.

The following guidelines provide steps to help reduce transmission of CA MRSA in certain community settings.

Gymnasiums, health clubs, spas

1. Wash hands upon entering and before leaving the premises. Alcohol gel may be used as an effective and convenient alternative to soap and water. If hands are visibly soiled, however, soap and water should be used.
2. Facilities should provide liquid soap dispensers instead of bar soaps for hand washing.
3. Use air blowers or disposable paper towels to dry hands rather than shared cloth towels.
4. Patrons should consider using clothing with long sleeves and long pants to protect skin from abrasions, cuts, and sores during activities that are likely to cause skin damage.
5. Areas of skin lesions or open sores should be covered with clean, dry dressings or bandages before using gymnasiums and health clubs.
6. Persons with skin lesions, open sores, or wounds with drainage that cannot be contained should not participate in activities that may contaminate surfaces and equipment.
7. Personal items such as towels, clothing, bar soap, razors, or clippers should not be shared.
8. Patrons are encouraged to shower at the end of activities.
9. Use a towel or wear clothing that acts as a barrier between skin and exercise equipment such as exercise machines and massage tables.
10. Wipe surfaces of equipment before and after use—facilities such as health clubs can encourage patrons to clean equipment surfaces by providing spray bottles of disinfectant and paper towels near each piece of equipment.
11. Facility staff should clean shared equipment surfaces daily to remove soil, then disinfect with an EPA-registered disinfectant according to manufacturer's instructions. Check the disinfectant label to make sure it is suitable for the material being treated (e.g. vinyl, cloth, plastic, wood) and that it is effective against *S. aureus*. The disinfectant must remain on the surface of equipment for the recommended contact time to be effective.
12. Used linens and clothing such as sheets, blankets, and towels should be washed in detergent and water at $\geq 160^{\circ}\text{F}$ for at least 25 minutes. If lower washing temperatures are used, oxygenated laundry detergents formulated for low temperature washing should be used. Use an automatic dryer on hot temperature (180°F) to dry items—do not air dry. Items should be used only after they are completely dry.

Sports Teams

The following measures may help prevent CA MRSA infections among participants in contact sports such as football, wrestling, hockey, basketball, etc.

1. Team members should practice good hand hygiene by washing hands when entering and leaving locker rooms, weight rooms and other common sports activity rooms, and prior to participating in practice or competition. Alcohol hand sanitizers may be used instead of soap and water if hands are not visibly soiled.
2. Cover any open wounds or sores before participating in sports activities. Make sure bandages and dressings stay in place during activities.
3. Consider excluding players with potentially infectious skin lesions from sports activities until wounds are healed or can be adequately covered.
4. Participants in contact sports should be encouraged to shower with soap and warm water after practice and competition. If there are active infections of MRSA among team members, consider implementing antibacterial soap for showering.
5. Locker rooms should have adequate sinks, showers, and soap supplies to encourage good personal hygiene.
6. Sports participants should not share personal items such as towels and razors.
7. Uniforms and equipment should be routinely cleaned after each use. Items that can be laundered should be washed in detergent and water at $\geq 160^{\circ}$ F for at least 25 minutes. If lower washing temperatures are used, oxygenated laundry detergents formulated for low temperature washing should be used. Use an automatic dryer on hot temperature (180°F) for items that can withstand those temperatures. Items should be used only after they are completely dry.
8. Maintain clean locker rooms and shower areas with regularly scheduled cleaning procedures.
9. Athletes, trainers, and coaches should be trained to watch for wounds and skin lesions among team members, and to recommend athletes seek medical care if lesions appear infected.

Schools and Work Settings

1. Hand hygiene should be facilitated by providing adequate hand washing facilities and supplies. Hand washing supplies should consist of soap dispensers rather than soap bars, and paper towels for single use instead of multiple use cloth towels. Use of alcohol hand sanitizers should be encouraged as a convenient alternative to use of soap and water, when hands are not visibly soiled.
2. Persons should wash hands after using rest rooms, before eating or drinking, after using tissue to cover sneezes or coughs, before and after use of gymnasium, weight rooms and other common sports activity areas, and whenever hands are contaminated or soiled.
3. Cover areas of open wounds or sores when possible. Wound drainage should be contained with bandages or dressings.
4. Persons with uncontained wound drainage or other infected body fluids should be excluded from school or work until wound drainage or body fluids are able to be contained.
5. Items and surfaces contaminated with blood, other body fluids, or wound drainage should be cleaned promptly using established protocols.
6. Common areas in school and workplace settings (e.g. cafeterias, rest rooms, locker rooms, common work stations) should be kept clean by following regularly scheduled cleaning protocols.

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